

teoarthritis (Kellgren-Lawrence score of 4) participated. Twenty-two persons without knee pain or radiographic evidence of arthritis comprised a healthy control group. Sagittal plane kinetics, knee adduction moment, sagittal plane knee excursion, ground reaction forces and knee joint reaction forces were calculated from 3-dimensional motion analysis at 1.0 m/s, self-selected and fastest tolerable walking speeds. Differences were analyzed using multivariate ANOVA and multivariate ANCOVA with speed as a covariate. A hierarchical regression was used to substantiate the results of the ANCOVA and to determine if radiographic severity of knee OA was related to changes in gait variables, even after accounting for differences in freely chosen walking speed.

Results: Persons with knee osteoarthritis showed significantly lower knee and ankle joint moments, ground reaction forces, knee reaction force and knee excursion when walking at freely chosen speeds. When differences walking in speed were accounted for in the analysis, the only difference found at all self-selected conditions was decreased knee joint excursion (Figure 1). The severity of knee OA was significantly related to the knee adduction moment and knee joint excursion, even when accounting for differences in walking speed.

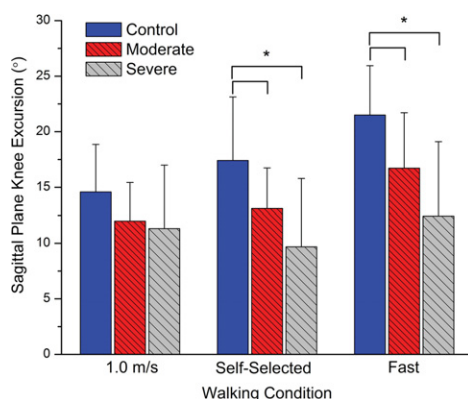


Figure 1

Conclusions: Compared to a healthy control group, persons with knee OA demonstrate differences in joint kinetics and kinematics. Many of these differences in gait parameters may be a result of slower freely chosen walking speeds rather than a result of disease progression. In addition, persons with severe knee OA may have difficulty compensating when challenged to walk faster their self-selected speed.

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CHANGES IN JOINT MOMENTS DUE TO KNEE OSTEOARTHRITIS ARE MODEL-DEPENDENT

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Purpose: In dynamic studies of gait, a mathematical joint model is used to attach physiological meaning to joint moments. However, there is no standard joint model; this means that some differences found in joint moments for OA gait could be artifacts of the choice of joint model. The purpose of this study is to identify features of lower-limb joint moments that are characteristic of subjects with moderate medial knee OA regardless of the choice of joint model.

Methods: 44 subjects with medial knee osteoarthritis and 44 asymptomatic control subjects walked at a self-selected speed. Symptomatic subjects were assessed using the WOMAC and radiographic Kellgren-Lawrence (KL) grading scales. 3D gait analyses were performed using an Optotrak motion analysis system and an AMTI force platform operating at 100Hz and 1000Hz,

respectively. Moments were calculated at the ankle, knee, and hip using a 3D inverse dynamics model of the lower extremity. Four alternative joint models were used to obtain clinically relevant moments: the proximal, distal, plane of progression, and joint coordinate system models. Moment features were extracted using both discrete peak estimates and principal component analysis (PCA). OA and control groups were compared using a two-way ANOVA with joint model as the repeated measure.

Results: Subjects with osteoarthritis were taller, heavier, older, and had a greater BMI than control subjects. There was no difference in walking speed between the two groups. OA subjects had mean \pm SD WOMAC pain scores of 7 ± 4 and function scores of 23 ± 13 . All OA subjects demonstrated moderate radiographic medial knee osteoarthritis with KL scores between 1 and 3.

Hip adduction moments were smaller for OA subjects at the late-stance peak, regardless of the choice of joint model. PCA also identified an overall reduction in magnitude across the entire stance phase. Knee adduction moments were larger at mid-stance in all joint models, but not significantly different at either the early- or late-stance peak. PCA detected an overall increase in magnitude throughout the stance phase in all joint models. Peak late-stance ankle dorsiflexion moments were significantly lower for OA subjects in all joint models, but no overall change was detected using PCA.

Conclusions: Gait analysis can provide objective measures of function that can be used as outcome measures in studies of OA. We found features of lower-limb joint moments that, regardless of the choice of joint model, were sensitive to gait changes associated with OA. However, we also found that some commonly-reported measures, such as the early- and late-stance knee adduction moment peaks are not reliable across joint models.

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THE RELATION OF DYNAMIC MECHANICAL LOADING TO BONE MARROW LESIONS IN MEDIAL KNEE OSTEOARTHRITIS

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Purpose: Bone marrow lesions (BMLs) are a characteristic feature of knee osteoarthritis (OA) that are associated with pain and increased rapidity of disease progression. To date however their etiopathogenesis remains unclear. Some hypothesise that BMLs are related to excessive mechanical loading. The aim of this study was to assess the relationship between measures of the external knee adduction moment (KAM) during walking (dynamic indicators of medial tibiofemoral compartment load) and presence of BMLs in people with symptomatic medial knee OA.

Methods: 91 (46 F, 45 M) participants with mild to moderate (KL grades 2 & 3) medial compartment knee OA were recruited. A Vicon motion analysis system and force plates were used to measure the external KAM as participants walked in usual footwear at their usual comfortable pace for 5 trials. The variables of interest were the overall peak KAM (Nm/BW*HT%) and the positive KAM angular impulse (Nm.s/BW*HT%) which is equivalent to the positive area under the adduction moment-time graph. BMLs were measured from a knee MRI scan taken in the sagittal plane on a 1.5-T whole body MRI unit with use of a commercial transmit-receive extremity coil. The image sequence was a coronal T2-weighted fat-saturated acquisition. BMLs were assessed by the same reader blinded to gait measurements using BLOKS semi-quantitative scoring system (intra-rater reliability - weighted kappa 0.88). For this analysis only BML grade for size in the medial weight bearing femur and medial tibia were used. Static knee alignment